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Surabaya smart subway development as an alternative mode in Ahmad Yani Corridor Surabaya by TOD concept application

Muhammad Ermando Nurman Sasono[a], Santika Purwitaningsih[a], Lukman Yusuf[a], Ardy Maulidy Navastara[b*]

[a]*Student of Urban and Regional Planning Department Sepuluh Nopember Institute of Technology, Keputih Sukolilo, Surabaya 60111, Indonesia*
[b]*Urban and Regional Planning Department Sepuluh Nopember Institute of Technology, Keputih Sukolilo, Surabaya 60111, Indonesia,*

Abstract

One of the phenomenon occured nowadays is the population increase. With the population raising, it will also be followed by the demand increase for transportation services. Along the corridor Ahmad Yani Surabaya evolve a linear region of Central Business District. Congestion in Jalan Ahmad Yani Surabaya according to data from a survey of Surabaya Transportation Agency in 2014, the average speed on Ahmad Yani corridor to various destinations around the connecting road only between 29.22 to 31.70 km/h. Congestion that occurs in peak hours was caused partly by high mobility, the volume of vehicles that do not fit with the capacity of the road, private car use too much, as well as the railway crossing which cause delays. Surabaya Smart Subway is the concept brought as an alternative modes of mass transportation with Transit Oriented Development theory application in Jl. Ahmad Yani in order to create a smart mobility paradigm.

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Keywords: Surabaya smart subway; TOD; ahmad yani corridor.

* Corresponding author. Tel.: +62-818-022-56056; fax: +0-000-000-0000 .
E-mail address: ardy.navastara@urplan.its.ac.id

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1. Introduction

An increasing number of population is become a phenomenon. Based on a census of 2010, the Indonesian population is 236.7 million. BPS's projection of the total population of Indonesia in 2019 reached 268.074.565 (www.ilo.org), and that number will increase to 288 million by 2050 and make Indonesia become the 6th most populated country in the world. Increases in population have impacts on various aspects of human needs, such as the transportation which is very influential on population mobility. The increase of population will also increases the demand for transportation services. Thus, the transportation system plan has to be guided by the concept of sustainability.

Along the corridor of Ahmad Yani in Surabaya evolve a Central Business District linearly. According to Raymond E. Murphy, CBD is the center of a city or region that is dominated by commercial activities. Corridor Ahmad Yani which is one of the primary arterial road of Surabaya should be planned a development concept with integrated transportation modes and system management which can accommodate people who require mobility in the corridor. It is important to include the other aspects such as land use to support the development concept that has been planned.

One of the problems that exist in Ahmad Yani street is traffic jam. According to data from a survey of Surabaya Transportation Agency in 2014, the average speed on Ahmad Yani street to various destinations around the connecting road is between 29.22 to 31.70 km/h. Congestion that occurs at peak hour was caused by high mobility, the volume of vehicles that do not fit with the capacity of the road, as well as the railway crossing which cause delays. Then, the public transportation availability is less feasible for the community, so that people prefer to use private transportation (Rozari and Wibowo, 2015).

Currently, the solutions that have been implemented as the respond to these problems is frontage road development. This solution was applied to overcome the problem of insufficient capacity of the road. However, the construction of frontage road will rise new problems. When the road becomes widespread, the number of vehicles will also increase. People's tendency to use private transportation will remain constant, even increasing as well. Moreover, the frontage road is frequently used by the informal trade sector which cause environmental pollution.

Surabaya Smart Subway developed by the theory of Transit Oriented Development (TOD) is an alternative solution to overcome the problem of people's mobility. The subway technology can be the first mass and rapid public transportation innovation in Indonesia. This paper has the following objective: i) to develop subway transportation concept to optimize underground space to accommodate people's mobility; ii) to apply the theory of Transit Oriented Development in mass transportation to make Surabaya become sustainable with the development of smart mobility concept. So, here is the problem that will be solved by this concept:

- There is not concept of development yet such an effective and efficient mass transportation in accommodating the mobility needs of the community in corridor Ahmad Yani Surabaya as shuttles impact on hours peak (peak hour)
- To apply theory to the Transit Oriented Development mass transport in realizing sustainable Surabaya through the development of smart mobility concept

2. Methods

In terms of methodology, the study took a comparative approach – it looked at what policies have been adopted and compared and analyzed the outcomes.

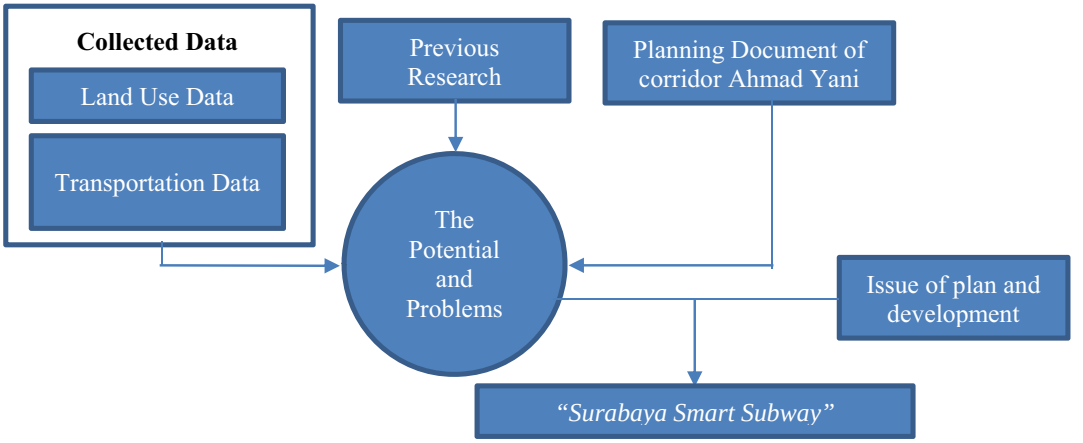

Fig.1. Method Diagram

3. Result and Discussions

3.1. Study Area

Study area which is determined is focused in CBD Royal Plaza. With the primary survey method, the boundary of the study area as follows.

- East : Jl. Gadung, Wonocolo District
- West : Railroads, Gayungan District
- North : Fly over road Jl. Ahmad Yani
- South : Jl. Taman Ketintang Baru IV, Gayungan District

As the CBD and regional trade, Royal Plaza has an high mobility and various activity. Due to lack of parking space around the CBD area led to the emergence use of the parking area in residents house. It could potentially increase the income of local people. In around of Jl. Ahmad Yani, there are three universities, namely University of Surabaya, Bhayangkara University , and the State Islamic Institute Sunan Ampel. The presence of three universities in the region resulted in an increasing number of mobility towards and out of the corridor Ahmad Yani. There are many locations that are used by cadger which causing congestion. But, the real problem caused the congestion in peak hours is actually by the mobility of commuters. Here is the proprortion of land use in study area that will be planned as a CBD Royal Plaza from spatial analysis using ArcGIS 10.1.

Table 1. The Proportion of Land Use in CBD Royal Plaza

No.	Land Use	Area (Ha)	Percentage (%)
1.	Public facilities	75,009057	56,34162563
2.	Commercial	17,619409	13,23448375
3.	Housing and settlement	40,504109	30,42389062
	Total	133,1326	100

Source: Surabaya Land Use Map 2013

3.2. Solution Offered Before

The following is solution ever offered to solve the problem with the results from the author review.

Table 2. Solution Offered Before

Parameter	Middle Highway	Frontage Road	Suro Tram Boyo Rail
Function	Connecting Surabaya city section of south and north	Adding space road to increase road capacity	Accommodates mobility by using mass transportation

Advantages	Adding road capacity	Adding road capacity	Using public mass transportation
Weakness	Degree of Saturation (DS) prediction in 2016 DS=0,956 and 2017 DS=1.029, normal DS=0,75 (Indratmo, 2012)	Frontage Road DS amounted to 1,322 (Indratmo, 2012)	Can not accommodates transportation needs at Jl. Ahmad Yani
Integration of transport modes	Low; on the highway, do not exist	Low	High
Preferences of mass transportation	Low	Low	High
Fuel savings contributions	Low	Low	High
Conclusion	Enhancement of road capacity using the Middle Highway predicted no effective.	Frontage Road is not effective, and does not provide mass transportation	This solution is quite good, but routes are not planned go through Jl. Ahmad Yani

Source: Author analysis, 2015

3.3. Surabaya Smart Subway based TOD

Ideas offered in this paper, namely Surabaya Smart Subway developed with the concept of Transit Oriented Development (TOD). By reviewing solutions offered or has ever applied, this idea is expected to be an alternative solution that is appropriate and more effective in addressing the problem of high commuter mobility that caused congestion in corridor Jl. Ahmad Yani Surabaya. Surabaya Smart Subway is a new transportation mode concept in Surabaya. Subway is a rapid mass public transportation. Surabaya Smart Subway network is a concept with a level where the level consists of two lines (double track). The path is part of the implementation plan for Double Track Surabaya-Malang route.

TOD concept is an evolution of the concept of urban planning that promote the principle of integration between land use / system activity with the city transportation system connecting. This concept directs the development of centers of activity city / area around the transit points (terminals, stations, bus/public transportation) to improve the accessibility of the city / region and ease of mobility. Through increased accessibility and mobility promoted by TOD concept is able to reduce the high dependence on private vehicle use. Surabaya Smart Subway can not stand alone. In other words, this concept should be supported by the integration with other public transport. Integration between modes takes place in the transit area. These public transport such as lyn, city buses, and taxis will be directed to enter the transit area.

In order to attract people to use Surabaya Smart Subway as the main transportation mode choice, itu must be equipped with some supporting facilites. The supporting facilities are listed below.

1) *Pedestrian Bridge.* In connecting the CBD area of the western with the eastern part on Jalan Ahmad Yani corridor, used pedestrian bridge. The pedestrian bridge futuristic design applying technology and ecology concept . Technology used is the automatic escalators as stairs. Escalator is driven by electrical energy derived from solar panels is the roof of the pedestrian bridge.
2) *General Electric Charging Station.*
   Human awareness that natural resources are non- renewable nature will eventually run out , making the man thought to be find more alternative energy is renewable The concept of subway carries environmental sustainability by applying General Electric Charging Station (SPLU). SPLU planned to be placed in the parking lot in the transit area.
3) *Pedestrian-friendly*
   Pedestrian-friendly concept is an effort to support the realization of the concept of subway . The concept of a pedestrian friendly area mean to facilitate pedestrians as well as a public appeal to walk. Construction of a pedestrian-friendly area is done Sidewalk construction include public seating and public tap water. Supporting facilities is expected to increase interest people to walk.
4) *Air Conditioner (AC)*

Subway is equipped with air conditioning or air conditioning. These facilities are increase the strength of the subway itself. Air conditioning, passengers will feel more comfortable in the train room.

5) *Free Wi-Fi*

Free Wi - fi facilities also support the concept of subway development. The facility is provided around the transit area. Target users in this facility is the portable or laptop computer users. Free wi - fi facility is appropriate in combination with a food court.

6) *Food Court*

To improve service subway, in the transit area provided food court . Food court is provided as a step relocation of traders five feet behind the Royal Plaza. The main purpose of this is food court settlement rearrangement that are near the railroad tracks behind the Royal Plaza.

Fig. 2. Development Concept Visualization

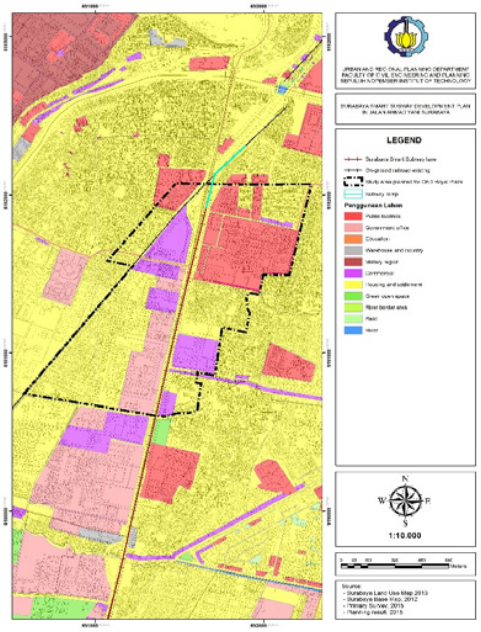

Fig. 3. Site Map of Development Plan

3.4. Milestones

In order to develop the concept of Surabaya Smart Subway, there must be maintained about the work phase and timeline. Here is the table of milestones in realizing the concept.

Table 3. Three Step of Planning and Development

Phase	Substance	Explanation	Output	Timeline
Planning	Reviewing the valid local planning document	In order to synchronize the concept and the local planning document	Easiness to achieve main aim of the development planned before	5-10 years
	Survey and analyze	*Identify existing location that will be developed*	Data needed in planning and designing	
	Planning and designing	Making a blueprint that contains planning and designing result	A master plan of TOD concept in CBD Royal Plaza	
	Administration necessity	Administration is needed to implement a concept, it will make sure that the concept will be success and to avoid administration problems	Administration document supporting the plan and design that has been made	
	Coordination of stakeholders	Make the same perception of stakeholders in concerned by consultation, creating a cooperative development between stakeholders	The stakeholders are in harmony, their interest has been accomodated	
Implementation	Do the physical development	Here is the key of concept realization, physical development done after	Built of infrastructure supporting TOD concept	10-15 years
	Preparing the regulation and policy related to the planning concept	Regulation and policy must be formulated and legalized by the government of every country concerned	Regulation and policy about TOD concept and Surabaya Smart Subway itself	
Evaluation	Do the evaluation periodically	Evaluation function is to provide the troubleshooting and improvement about the concept	Evaluation result of concept implementation	Periodical

Source: Author analysis, 2015

3.5. Development Financing

Financing models offered to implement Surabaya Smart Subway project is to use the model Build Operate Transfers. Built Operate Transfer is a business partnership where private organizations take over the development and operation of facilities are normally carried out by the government (Menheere and Pollalis, 1996). BOT project financing with the cover of the feasibility study, procurement, financing, up to the operation. Here the project implementers got the concession for a certain period in order to take the economic benefits and ultimately restore all of those assets to the government at the expiry of the concession period.

3.6. Ideas Transfer Possibility

One key to the sustainability of development lies in the possibility of the idea of development applications in other case studies. The concept of Surabaya Smart Subway can be applied to places that have characteristics similar to study area. The characteristics are:

- It is the equivalent of a metropolitan city
- It is the CBD (central activity)
- Has the activity of high traffic movement

4. Conclusions

Surabaya Smart Subway developed by the theory of Transit Oriented Development can overcome public's mobility such as: i) decrease the traffic jam in corridor Ahmad Yani caused by high mobility at peak hour by reducing public's tendency to private transportation; ii) reduce air pollution and fuel consumption; iii) reduce train crash in corridor of Ahmad Yani; and iv) become an innovation of transportation system in Indonesia, especially become an icon of mass and rapid public transportation in Surabaya.

Surabaya Smart Subway cannot stand alone as public transportation. Improvement of quality of the other modes performance is needed to be enhanced in order to create and integrate the transportation system which be the main characteristic of Transit Oriented Development concept.

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